

AMENDMENTS TO THE CLAIMS

This listing of claims reflects all claim amendments and replaces all prior versions, and listings, of claims in the application. Material to be inserted is in **bold and underline**, and material to be deleted is in strikeout or (if the deletion is of five or fewer consecutive characters or would be difficult to see) in double brackets [[]].

1. (Original) A needle-less hypodermic jet injection device comprising: a pre-filled drug injection cartridge including:
 - a medication cylinder having an outlet orifice,
 - an injection nozzle,
 - a flow path communicating the outlet orifice to said injection nozzle,
 - a drug-injection piston in a first position cooperating with said medication cylinder to define a variable-volume chamber of first selected size,
 - a dose of substantially incompressible liquid medication substantially filling said variable-volume chamber at said first size with substantially no ullage volume,
 - said drug-injection piston having a second position cooperating with said medication cylinder to define a variable-volume chamber of second selected size smaller than said first selected size;
 - a hand piece assembly having a body holding said drug injection cartridge, said hand piece assembly including a source of pressurized gas, and means for selectively applying force from said pressurized gas to said drug injection piston to move said drug injection piston from said second

position to a third position substantially ejecting said dose of liquid medication via said injection nozzle;

said hand piece assembly including a first body portion holding said drug injection cartridge, and a second body portion manually movable relative to said first body portion, said second body portion including an abutment member selectively movable into engagement with said drug injection piston in response to manual relative movement of said first and second body portions to move said drug injection piston from said first position to said second position.

2. (Original) The device of claim 1, wherein said hand piece assembly further includes a first bore within said first body portion, a gas power piston movably received in said bore and having a ram portion extending into said drug injection cartridge to abut with said drug-injection piston, said body and gas-power piston cooperating to define a first variable-volume gas-power chamber in said first bore;

said hand piece assembly further including a second body portion adjustably engaging with said first body portion, said second body portion defining an elongate second bore in gas flow communication with said first bore gas-power chamber and separated therefrom by a wall portion carried by said second body portion.

3. (Original) The device of claim 2 wherein said first body portion and said second body portion are threadably and adjustably engaged with one another, said second body portion carrying said abutment member.

4. (Original) The device of claim 3 wherein said wall portion includes said abutment member.

5. (Original) The device of claim 2 wherein said second body portion in said second bore further carries a cylindrical gas capsule, said cylindrical gas capsule providing said source of pressurized gas.

6. (Original) The device of claim 5 wherein said hand piece assembly second body portion is cylindrical, and a tubular trigger sleeve is movably carried by said second body portion to effect opening of said gas capsule.

7. (Original) A needle-less hypodermic jet injection device comprising:
a pre-filled drug injection cartridge including: a medication cylinder having an outlet orifice, a plug member in a first position sealingly closing the outlet orifice, an injection nozzle, a flow path communicating the outlet orifice to said injection nozzle and providing a chamber for capturing said plug member in a second position, a drug-injection piston in a first position cooperating with said medication cylinder to define a variable-volume chamber of first selected size, a dose of substantially incompressible liquid

medication substantially filling said variable-volume chamber at said first size with substantially no ullage volume, said drug-injection piston having a second position cooperating with said medication cylinder to define a variable-volume chamber of second selected size sufficiently smaller than said first selected size that said plug member is hydraulically forced from said first position at said outlet orifice and to a second position in said chamber;

a hand piece assembly having a two-piece body having a first body portion holding said drug injection cartridge, and a second body portion providing an abutment movable relative to said first body portion to move said drug injection piston between said first and second positions;

a source of pressurized gas including a hermetically sealed metallic gas capsule; trigger means for selectively penetrating said gas capsule and for applying force from said pressurized gas to said drug injection piston to move said drug injection piston from said second position to a third position substantially ejecting said dose of liquid medication via said injection nozzle.

8. (Original) The device of claim 7, wherein said first body portion defines a first bore, a gas-power piston movably received in said first bore, said gas-power piston having a piston head and a ram portion extending into said drug injection cartridge to abut with said drug-injection piston, said first body portion and said gas-power piston cooperating to define a first variable-volume gas-power chamber in said first bore;

said second body portion sealingly and movably engaging with said first body portion to bound said gas-power chamber, said second body portion defining an elongate second bore in gas flow communication with said gas-power chamber, and said gas capsule being received into said second bore.

9. (Original) The device of claim 8 wherein said first body portion and said second body portion are threadably and adjustably engaged with one another, said second body portion including said abutment on a wall portion separating said second bore from said gas-power chamber.

10. (Original) A jet injection device comprising:

a drug cartridge having a cylinder in which is movable a piston to cooperatively define a variable-volume chamber for holding a dose of liquid medication;

a fine-dimension injection orifice in liquid flow communication with the variable-volume chamber to receive the liquid medication and discharge this medication as a high velocity forceful jet for hypodermic jet injection of the medication upon forceful movement of said piston in said cylinder;

a power source for forcefully moving said piston in said cylinder in response to triggering of said injection device, and

a trigger assembly for initiating forceful movement of said piston, said trigger assembly including a hammer member having a plurality of legs each having an end surface, a sear ring member upon which said end surfaces

of said legs rests in a first position of the hammer member, means for urging said hammer member to a second position, and a trigger sleeve surrounding said hammer member and having a respective plurality of contact portions each engaging one of the plurality of legs to move said legs out of engagement with said sear ring upon axial movement of said trigger member.

11. (Original) The injection device of claim 10 wherein said hammer member includes a central wall portion from which extends in one axial direction a skirt defining a spring seat, said power source including a spring received into said skirt and into engagement with said central wall portion, said multitude of legs extending axially from said central wall portion in an opposite axial direction.

12. (Original) The injection device of claim 11 wherein said hammer member is a unitary molding of plastic polymer.

13. (Original) The injection device of claim 10 wherein said hammer member includes a first circular cylindrical portion and a second conically flaring portion axially arranged with one another.

14. (Original) The injection device of claim 13 wherein said first circularly cylindrical portion extends in one direction from said central wall portion, and said plurality of legs cooperatively define said second conically flaring portion and extend axially in said opposite axial direction from said central wall portion.

15. (Original) The injection device of claim 14 wherein said conically flaring portion has a conical diameter at an end of said hammer member, said plurality of legs are each part-circular segments having circular radii which are substantially equal to the radius of the circular cylindrical portion, whereby, said sear ring has an inner diameter substantially equal to said circular cylindrical portion of said hammer member and said plurality of legs in a second position are nested circumferentially adjacent to one another within said sear ring member.

16. (Original) A unitary elongate molded plastic polymer hammer member, said hammer member comprising:

a central wall portion extending radially;

a circular cylindrical portion extending axially in one direction from said central wall portion, said circular cylindrical portion including a tubular skirt and cooperating with said central wall portion to define a spring seat into which a spring may be received to engage upon said central wall portion;

a conically flaring portion extending in an opposite axial direction from said central wall portion, said conical portion including a plurality of circumferentially spaced apart resilient legs each extending axially to

terminate in a respective axial end surface engageable with a sear ring in a first position of the legs to support said hammer member in opposition to force from the spring exerted on said central wall portion, said legs in said first position cooperatively defining a conical diameter at said end surfaces, and said legs at said end surfaces each also defining a circular radius which are substantially equal to the radius of said circular cylindrical portion;

whereby, said plurality of legs are movable to a second position in opposition to said resilience of said legs, in said second position said plurality of legs being circumferentially nested adjacent to one another and cooperatively defining a diameter substantially equal to that of said cylindrical portion.

17. (Original) A method of operating a needle-less hypodermic jet injection device using an injection cartridge having a cylinder receiving liquid medication, an orifice for forming the liquid into a high-velocity hypodermic injection jet, a plug member in a first position sealingly separating said medication from said orifice, and said plug member in a captive second position allowing communication of medication to said orifice, and an injection piston movable sealingly in said cylinder to displace said liquid medication via said orifice; said method including steps of:

providing said device with a two-piece body having a first body portion defining a first bore into which is received a gas-power piston, and a second body portion defining a second bore into which is sealingly and movably received a hermetically sealed pressurized gas capsule; utilizing said first

and second body portions and said gas-power piston to cooperatively define a variable-volume chamber; and

first relatively moving said first and second body portions to forcefully move said plug member from said first position to said captive second position to unseal said injection cartridge, and then

utilizing communication of pressurized gas from said pressurized gas capsule into said variable-volume chamber to forcefully move said gas-power piston to displace said liquid medication from said cartridge via said orifice to effect a hypodermic jet injection.

18. (Original) The method of operating a needle-less injection device of claim 17 further including the step of utilizing a unitary molded plastic polymer hammer member to drive said gas capsule upon an impaling spike communicating pressurized gas to said variable-volume chamber.

19. (Original) A method of operating a needle-less hypodermic jet injection device using an injection cartridge having a cylinder receiving liquid medication, an orifice for forming the liquid into a high-velocity hypodermic injection jet, a plug member sealingly separating said medication from said orifice, and an injection piston movable sealingly in said cylinder to displace said liquid medication via said orifice; said method including steps of:

providing said device with a two-piece body having a first body portion defining a first bore into which is received a gas-power piston, and a second body

portion defining a second bore into which is sealingly and movably received a hermetically sealed pressurized gas capsule; utilizing said first and second body portions and said gas-power piston to cooperatively define a variable-volume chamber; and

first relatively moving said first and second body portions to forcefully move said plug member to unseal said injection cartridge, and then utilizing communication of pressurized gas from said pressurized gas capsule into said variable-volume chamber to forcefully move said gas-power piston to displace said liquid medication from said cartridge via said orifice to effect a hypodermic jet injection;

further including the step of providing said molded unitary plastic polymer hammer member with a plurality of axially extending legs each having an end surface engaging upon a sear ring surface to support said hammer member, and simultaneously slipping said plurality of legs off of said sear ring surface radially inwardly to be received in circumferentially adjacent nested position within said sear ring surface to allow axial movement of said hammer member.

20. (Original) A needle-free hypodermic jet injection device comprising:

a body substantially formed of plastic polymer;

a jet injection cartridge carried by said body and including a cylinder and piston cooperatively defining a variable-volume chamber receiving a dose of liquid medication, and a fine-dimension jet injection orifice in liquid flow communication with said variable volume chamber;

a metallic pre-filled hermetically-sealed single-use gas pressure cartridge axially movably disposed in said body, said gas pressure cartridge having a penetrable wall portion and said body including a penetrator axially spaced from and confronting said penetrable wall portion for penetrating said penetrable wall portion of said gas cartridge and releasing pressurized gas from said cartridge;

said device further including means responsive to pressurized gas released from said gas pressure cartridge for applying force to said liquid medication to eject said medication via said jet injection orifice;

said device further including means for selectively moving said gas pressure cartridge axially and impaling said gas pressure cartridge at said penetrable wall portion upon said penetrator in response to a singular user input so as to release pressurized gas from said gas pressure cartridge and to eject said medication via said jet injection orifice to effect a hypodermic jet injection.

21. (New) A needle-less injection device, comprising:

a liquid container having an outlet orifice;

an injection orifice fluidly coupled with the outlet orifice and configured to inject

liquid forwardly out of the needle-less injection device substantially along an

injection axis into an injection site;

a plug member displaceable from a first position, in which it sealingly closes the

outlet orifice, to a second position, in which liquid is permitted to flow out of

the outlet orifice; and

plural bypass conduits defined between the outlet orifice of the liquid container and

the injection orifice in a plug capture chamber when the plug member is in

the second position, the plural bypass conduits being defined by walls of the

plug capture chamber and the plug member such that the bypass conduits

permit liquid to flow from the outlet orifice past the plug member to the

injection orifice,

where a portion of the walls of the plug capture chamber extend at acute angles

relative to a portion of the injection axis extending along the bypass

conduits.

22. (New) The device of claim 21, where the plug member moves forwardly

along the injection axis when displaced from the first position to the second position.

23. (New) The device of claim 21, where the bypass conduits converge

forwardly of the plug member when the plug member is in the second position, such that

streams of liquid flowing past the plug member through the bypass conduits converge into a single stream between the plug member and the injection orifice.

24. (New) The device of claim 21, further comprising a plurality of ribs extending radially inward from the wall of the plug capture chamber.

25. (New) The device of claim 24, where the bypass conduits are defined by the ribs, the wall of the plug capture chamber, and by the plug member when the plug member is in the second position.

26. (New) The device of claim 25, where the plug member moves forward along the injection axis when displaced from the first position to the second position, and where the ribs are configured to block the plug member from further forward movement toward the injection orifice when the plug member is in the second position.

27. (New) A needle-less injection device, comprising:

a liquid container having an outlet orifice;

an injection orifice fluidly coupled with the outlet orifice and configured to inject

liquid forwardly out of the needle-less injection device substantially along an

injection axis into an injection site;

a plug member displaceable from a first position, in which it sealingly closes the

outlet orifice, to a second position, in which liquid is permitted to flow out of

the outlet orifice; and

a plug capture chamber interposed between and fluidly coupling the outlet orifice

with the injection orifice, the plug capture chamber being adapted to receive

and hold the plug member when the plug member is displaced to the second

position, so that the plug member does not prevent liquid from flowing from

the outlet orifice to the injection orifice,

where plural bypass conduits are defined within the plug capture chamber such

that, when the plug member is in the second position, the bypass conduits

permit liquid to flow from the outlet orifice past the plug member to the

injection orifice,

and where each bypass conduit is at least partially defined by a wall of the plug

capture chamber that extends non-perpendicularly relative to the injection

axis along the bypass conduit.

28. (New) The device of claim 27, wherein a portion of the wall of the plug capture chamber that defines each bypass conduit extends at an acute angle relative to a portion of the injection axis extending along the bypass conduit.

29. (New) The device of claim 27, where the plug member moves forwardly along the injection axis when displaced from the first position to the second position.

30. (New) The device of claim 27, where the bypass conduits converge forwardly of the plug member when the plug member is in the second position, such that streams of liquid flowing past the plug member through the bypass conduits converge into a single stream between the plug member and the injection orifice.

31. (New) The device of claim 28, where the plug capture chamber includes a plurality of ribs extending radially inward toward the injection axis.

32. (New) The device of claim 31, where the bypass conduits extend between the ribs and are defined in part by the ribs.

33. (New) The device of claim 32, where the plug member moves forward along the injection axis when displaced from the first position to the second position, and where the ribs are configured to block the plug member from further forward movement toward the injection orifice when the plug member is in the second position.

34. (New) A needle-less injection device, comprising:

a liquid container having an outlet orifice;

an injection orifice fluidly coupled with the outlet orifice and configured to inject

liquid forwardly out of the needle-less injection device substantially along an

injection axis into an injection site; and

a plug member displaceable from a first position, in which it sealingly closes the

outlet orifice, to a second position, in which liquid is permitted to flow out of

the outlet orifice,

where the plug member contacts a plug capture structure within a plug capture

chamber when in the second position, and where plural bypass conduits are

formed in the plug capture structure to permit liquid to flow from the outlet

orifice past the plug member to the injection orifice, and where the bypass

conduits are defined at least partially by walls of the plug capture chamber

and the plug member when in the second position, the walls extending at

acute angles relative to a portion of the injection axis extending along the

bypass conduits.

35. (New) A needle-less injection device, comprising:

a container having an outlet orifice;

an injection orifice configured to inject liquid forwardly out of the needle-less

injection device substantially along an injection axis into an injection site; and

a plug member displaceable from a first position, in which it sealingly closes the

outlet orifice, to a second position, in which liquid is permitted to flow out of

the outlet orifice and to the injection orifice,

where, in the second position, the plug member abuts a plug capture structure

disposed between the outlet orifice and the injection orifice in a plug capture

chamber, and

where a plurality of bypass conduits are formed in the plug capture structure by

walls of the plug capture chamber and the plug member to permit liquid to

flow from the outlet orifice around the plug member along the plurality of

bypass conduits that converge forwardly of the plug member between the

plug member and the injection orifice, each bypass conduit being shaped so

that, liquid emerging from the bypass conduit into where the bypass conduits

converge flows in an acute direction relative to a portion of the injection axis

extending along the bypass conduits.